PRECISE ENVIRONMENTAL
Consulting Environmental Scientists

CONCEPT POTABLE WATER MANAGEMENT STRATEGY

Nightcap Village

Mount Burrell (Kunghur), New South Wales

NCV Enterprises Pty Ltd

November 2020

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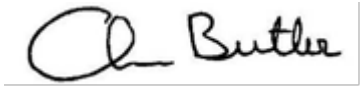

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1 INTRODUCTION

Precise Environmental (PE) was commissioned by NCV Enterprises Pty Ltd to prepare a concept Potable Water Management Strategy (CPWMS) for the proposed Nightcap Village precinct at Mount Burrell, New South Wales. The location of the site is shown in Appendix A, Drawing Number A104.

The Nightcap Village will consist of a maximum of 459 residential dwellings, to be situated along prominent ridgelines within the precinct. Detailed plans for each dwelling site are not currently available.

1.1 Objectives

The objectives of this CPWMS are to:

- Provide guidance for the collection, treatment, validation and distribution of water for an individual dwelling
- Provide guidance on water quality requirements for the dwellings within the site.

1.2 Guidance documents

This report was prepared with reference to the following guidance documents:

- Australian Drinking Water Guidelines Version 3.5 (NHMRC 2018)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)
- AS/NZS 4020 Testing of products for use in contact with drinking water
- AS/NZS 1547:2012 Onsite domestic-wastewater management
- AS 2070 Plastics materials for food contact use
- Guidance on use of rainwater tanks (Enhealth 2011)
- New South Wales Private Water Supply Guidelines (NSW Health 2016).

1.3 Limitations

The findings of this report are based on the objectives and scope of work outlined above. PE performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession. No warranties or guarantees, express or implied, are made. Subject to the scope of work, PE's assessment is limited strictly to identifying typical environmental conditions associated with the subject property, and does not include evaluation of any other issues.

This report does not comment on any regulatory obligations based on the findings, for which a legal opinion should be sought. This report relates only to the objectives and scope of work stated, and does not relate to any other works undertaken for the client. The report and conclusions are based on the information obtained at the time of the assessment. Changes to the surface and subsurface conditions may occur subsequent to the investigation described herein, through natural processes or through the intentional or accidental addition of contaminants or ground works, and these conditions may change with space and time.

The results of this assessment are based upon site inspection and fieldwork conducted by PE personnel and information provided by the client. All conclusions regarding the property area are the professional opinions of the PE personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, PE assumes no responsibility or liability for errors in any data obtained from regulatory agencies,

information from sources outside of PE, or developments resulting from situations outside the scope of this project.

2 SITE IDENTIFICATION, CHARACTERISTICS AND ENVIRONMENTAL SETTING

2.1 Site details and zoning

The allotments which form the Nightcap Village precinct are provided in Table 1.

Table 1. Project details

Aspect	**Detail**		
Project Name:	Nightcap Village		
Site identification:	Allotment	Area (hectares)	Address
	Lot 4 DP737440	90.82	2924 Kyogle Road, Kunghur, NSW
	Lot 2 DP582300	71.71	2954 Kyogle Road, Kunghur, NSW
	Lot 31 DP755714	88.03	
	Lot 32 DP755714	125.45	
	Lot 22 DP755714	46.54	
	Lot 19 DP755714	48.56	
	Lot 8 DP755714	16.19	
	Lot 1 DP390311	162.27	
	Lot 2 DP611556*?	122.40	
	Lot 1 DP611556*	5.06	
	Lot 33 DP755714	9.90	
	Lot 5 DP582299	134.1	
	Lot 3 DP755714	37.94	
	Lot 35 DP755714	30.76	
	Lot 121 DP134446*	158.17	
	Lot 11 DP1194471	126.60	
	Lot 1 DP1183098	3.02	
	Lot 34 DP755714*	47.04	2956 Kyogle Road, Kunghur, NSW
	Lot 20 DP755714	177.25	3222 Kyogle Road, Mount Burrell, NSW
	Lot 2 DP1148316*	81.51	
	Total site area	**≈1,583.32**	
Existing built structures:	There are existing residential dwellings on the allotments specified above as indicated by an asterisk (*). This CPWMS does not address potable water strategies for existing dwellings.		
Proposed potable water supply:	Potable water will be supplied via rainwater harvesting from dwelling rooves, and tanker imports (as required). Where required potable water will be supplied via rainwater harvesting from communal / recreational structures such as halls and buildings.		

A summary of the site details and zoning are provided in Table 2.

Table 2. Land use and surrounding land details.

Aspect	**Detail**
Local Government	Tweed Shire Council (TSC)
Parish	Kunghur
County	Rous
Current / proposed zoning (TSC)	TSC Local Environmental Plan (LEP) 2014 mapping shows the site as predominantly being within 'RU2 – Rural landscape' zone and a small section on the eastern side of the site being within 'RU5 – village' zone.
Existing land use and site structures	A mixture of remnant bushland and forestry plantation covers the majority of the site with access tracks and fire trails throughout. Cleared areas with rural use containing numerous houses and sheds are present predominantly through the centre, north and eastern areas.
Proposed land use	Residential
Surrounding land use	National Parks and Nature Reserves (Mebbin state forest) lies along the western site boundary and Rural landscape surrounds the remaining site boundaries. Environmental protection (habitat) is mapped ~ 900m north west of the boundary. Sensitive environmental mapping is provided in Appendix C.

3 RAINWATER TANK SIZING AND POTABLE WATER COLLECTION

Sizing of rainwater tanks for a dwelling is a critical component for a potable water supply where there is no municipal water available. For the purposes of this concept design. PE has assessed the rainwater tank volume which would be required based on a roof area of typical 180 m^2 (15 m x 12 m) and monthly rainfall data obtained from Bureau of Meteorology (BOM) for Kunghur (The Junction), station number 58129. Rainfall data from July 1966 – February 2019 has been used and a summary of the statistical data is shown below in Table 3. This weather station is 2.2 km southeast of the site.

Table 3. Rainfall data.

Rainfall statistic (mm)	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**Annual**
Mean	173.9	190.2	205.0	110.5	122.4	102.7	52.3	49.9	43.0	102.1	107.8	144.8	1,408.5
Minimum	0	11	16	21.4	7.6	6.4	0	0	0	8	21.9	27	695
90th %ile	309.6	356.7	303.6	215.7	218	231.8	119.3	116	80.3	192.6	176.4	217.2	2,040.6
Maximum	717.8	495.8	930	617.4	692.6	747.5	312.9	226.4	169.6	587.6	325	555.4	2,504.3

Table notes:

The statistical values for annual rainfall are not equal to the sum of all months because of missing data points for some months in the data between July 1966 and February 2019.

The above historical rainfall data indicates there are a number of months in the year which have had no rainfall (i.e. January, July, August and September, which is an important consideration for the purposes of sizing a rainwater tank with enough storage capacity to provide water to a dwelling during periods of low or no rainfall.

The Australia Government Department of Health (DoH) has published guidance for the purposes of calculating the maximum volume of rainwater that can be harvested for any given dwelling. The equation is as follows:

V = A x (R – B) x roof area (m^2)

Where

V = volume of rainwater harvested (L/year)

A = Efficiency of rainwater collection (DoH uses a value of 0.8 – 0.85 representing % efficiency)

B = Loss of water associated with absorption and wetting of surfaces (DoH uses a value of 24 mm/year)

R = Rainfall (mm/year)

Rainfall harvesting volume for an individual dwelling based on mean rainfall:

V = 0.8 x (1,408.5 – 24) x 180

= **199,368 L/year.**

The above annual rainwater harvestable is equivalent to a supply of ~ 546 L/day per dwelling. It is assumed that the efficiency of rainwater collection is based on what is typical for a residential dwelling and this can change substantially between dwellings. Notwithstanding this, if specific

dwelling design factors were incorporated that could increase the efficiency of rainwater collected this number could be increased.

The DoH website also provides a simple equation for calculating the volume of rainwater in a rainwater tank at the end of each month, and the total water demand for a typical dwelling. The equation assumes that at the start of 'wetter' months the tank is empty. The following formula is then used:

V_t = V_{t-1} + (Volume of rainwater harvested – Demand)

Where

V_t = theoretical volume of water remaining in the tank at the end of the month

V_{t-1} = volume of water left in the tank from the previous month

PE has provided two scenarios for establishing a start point for the water supply. Both scenarios have assumed that rainwater harvesting commences in January. Table 4 details the theoretical yield and calculation of V_t on a running scale assuming the rainwater tank/s with volume of 50,000 L is empty, V_{t-1} will be 0 at this time. Table 5 assumes the rainwater tank/s with volume of 50,000 L is half filled (i.e. V_{t-1} = 25,000) in January. A negative V_t value means there is a water deficit and other strategies would need to be incorporated to provide greater security of the water supply.

A monthly breakdown of the annual rainfall harvesting volume based on mean monthly rainfall is also provided in the tables below. The monthly water demand has been based on a predicted water demand of 150 L/person/day which is considered to be reasonable given the sewage flow allowance of 120 L/person/day stipulated in AS/NZS 1547:2012 as per PE's concept onsite sewage management design report (PE 2019) and that this development is considered an eco-village, where water use should not be excessive.

Table 4. Theoretical monthly rainfall harvesting volume [V = A x (R – B) x roof area (m^2)] and water demand assuming rainwater tank is empty in January.

Year 1						
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Harvesting Volume (L)	24,753.6	27,100.8	29,232	15,624	17,337.6	14,500.8
Water demand (L)	18,600	16,800	18,600	18,000	18,600	18,000
V_t (L)	6,154	16,454	27,086	24,710	23,448	19,949
Month	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Harvesting Volume (L)	7,243.2	6,897.6	5,904	14,414.4	15,235.2	20,563.2
Water demand (L)	18,600	18,600	18,000	18,600	18,000	18,600
V_t (L)	8,592	-3,110	-15,206	-19,392	-22,157	-20,194

Table 5. Theoretical monthly rainfall harvesting volume [V = A x (R – B) x roof area (m^2)] and water demand assuming rainwater tank is half full (25,000 L) in January.

Year 1						
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Harvesting Volume (L)	24,753.6	27,100.8	29,232	15,624	17,337.6	14,500.8
Water demand (L)	18,600	16,800	18,600	18,000	18,600	18,000
V_t (L)	31,154	41,454	52,086*	49,710	48,448	44,949
Month	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Harvesting Volume (L)	7,243.2	6,897.6	5,904	14,414.4	15,235.2	20,563.2
Water demand (L)	18,600	18,600	18,000	18,600	18,000	18,600
V_t (L)	33,592	21,890	9,794	5,608	2,843	4,806
Year 2						
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Harvesting Volume (L)	24,753.6	27,100.8	29,232	15,624	17,337.6	14,500.8
Water demand (L)	18,600	16,800	18,600	18,000	18,600	18,000
V_t (L)	10,960	21,261	31,893	29,517	28,254	24,755
Month	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Harvesting Volume (L)	7,243.2	6,897.6	5,904	14,414.4	15,235.2	20,563.2
Water demand (L)	18,600	18,600	18,000	18,600	18,000	18,600
V_t (L)	13,398	1,696	-10,400	-14,586	-17,350	-15,387

Table note: *A potential over top of a 50,000 L tank is noted in March (Year 1) of 2,086 L, however there has been no adjustment of the V_t value for the corresponding 15 months.

Table 4 indicates that there would be sufficient rainfall to provide enough water until the end of July, with a water deficit noted from August onwards. However, by prefiling a 50,000 L capacity tank/s with 25,000 L of imported water, the water supply could last potentially up to 1 year and 8 months.

It is acknowledged that the water demand is greater than the theoretical volume from April - November (based on 180 m^2 roof area and average rainfall), and the deficit of water in these months reduces the total volume of water in the tank. Based on this theoretical water deficit, additional strategies may be required to provide a secure supply of potable water to a dwelling and may include but not be limited to:

- Incorporate dwelling specific design concepts to increase the efficiency of roof water collection (e.g. increase the roof area or increase the efficiency of a roof's ability to harvest water to > 80%)
- Incorporate full water reduction fixtures into each dwelling to reduce the potential water demand which may include:
    - Reduced flush 6/3 litre toilets, waterless urinals and/or composting toilets
    - Shower flow restrictors
    - Aerator faucets
    - Flow/pressure control valves on water use outlets (where applicable)

- Timed flow tapware

- Provide an on demand tanker import service to top up water tanks on an as required basis.

Notwithstanding the requirement to increase the security of the water supply, a full rainwater tank/s with a total capacity of 50,000 L would provide water supply for ~ 2.75 months in the event there was no rainfall (as is demonstrated in Table 6, where minimum rainfall is 0 mm between July and September). Increasing the total capacity of the rainwater tank/s or the rainwater harvesting efficiency would improve the security of the water supply, and reduce the frequency that tanker imports would be required.

The above scenarios do not cater for firefighting water that will need to be sourced and managed separately according to regulator requirements.

It is understood that many of these proposed dwellings will be constructed for holiday homes with minimal occupancy except for school holiday periods. Under this scenario the annual water demand would be greatly reduced to that specified in Table 5.

3.1 Rainwater storage tanks

The Guidance on use of rainwater tanks references four main types of rainwater tanks which could be considered for installation in a domestic setting and are as follows:

- Galvanised steel tanks
- Concrete tanks
- Fibreglass tanks
- Plastic tanks and tanks with plastic liners.

Each tank has its own benefits and limitations in terms of construction, location (above or below ground) and broader requirements in terms of minimising contamination risk of stored potable water. Any storage tanks must be compliant with AS 2070 and if a plastic tank is selected it is recommended to be of a food grade standard complying with AS/NZS 4020. Based on the potential harvesting capacity of a typical dwelling discussed in the preceding section, a minimum tank capacity of 50,000 L is recommended for each dwelling, however this capacity should be increased where additional security of water supply is warranted.

Recreational areas can similarly provide rainwater harvesting and storage tanks. Measures to safeguard community water supply (see Section 4.6) must be implemented for community potable water to mitigate any risk to public health.

Additional management measures may include routine water quality testing and record keeping (managed by the Community Management Committee or others), signage depicting potable versus non potable water in communal areas, and tank size / location that considers the intended use of the specific communal/ recreational areas. Given that the communal areas and facilities will be designated through subsequent development application stages and based on the community need, specific water supply detail will be provided at the detailed design stages and be fit for purpose.

3.2 Requirement for tanker imports

Anecdotal evidence provided by Peter Vanlieshout, one of the existing landowners within the site, has indicated that in the last 12 years, he has only had to import potable water into his tanks twice during periods of drought. He advised his roof area is 196 m^2 (14 x 14 m) and he also

harvests water from his carport which is 80 m² (8 x 10 m). Based on these circumstances, it is foreseeable that the frequency of tanker imports will be minimal.

While impacts to local roads as a result of heavy vehicle movements should not be overlooked, the primary access road in and out of the site is Kyogle Road, which functions as the primary movement of traffic between Murwillumbah and Kyogle and is capable and suitable for heavy vehicle movements through to all surrounding areas. The internal road network at the site has been design to Roads and Maritime Services (RMS) heavy vehicle standards. It is anticipated that there will be no substantiated impacts to internal or external roads as a result of tanker deliveries at the site.

Where tanker imports are unable to source water from the nearest public water supply (understood to be located in Uki), water can be sourced from outside the Tweed Shire Council area via private tanker.

4 WATER SUPPLY MANAGEMENT

4.1 What is drinking water (potable water)

The Australian Drinking Water Guidelines (NHMRC 2018) provides the following definition for drinking water:

> *Drinking water is defined as water intended primarily for human consumption, either directly, as supplied from the tap, or indirectly, in beverages, ice or foods prepared with water. Drinking water is also used for other domestic purposes such as bathing and showering.*
>
> *With the exception of bottled or packaged water, the ADWG apply to any water intended for drinking irrespective of the source (municipal supplies, rainwater tanks, bores etc) or where it is consumed (the home, restaurants, camping areas, shops etc).*

Appendix I of the ADWG provides guidance for the effective management of drinking water. This management strategy broadly follows the systematic approach to manage water quality. and documents the routine assessment of drinking water system hazard controls and implementation of preventative / corrective measures in the event that health risks are identified.

4.2 Water supply and end uses

Anticipated water sources and uses are provided in Table 6.

Table 6. Water supply options and end uses

Type	Raw water source	Use
Potable water – water suitable for drinking	– Roof water harvesting – Tanker imports	– Sinks – Exterior taps – Showers/baths – Hand basins

The below strategy does not make allowance for raw water sourced from dams, creeks or groundwater. The risk associate with these addition raw water sources would require amendments to be made to this strategy.

4.3 Potential water supply hazards

Potential hazards for the water supply include the following:

- Animal faeces
- Dead animals
- Decaying organic material
- Arial sprays
- Cross connection with onsite wastewater irrigation systems
- Naturally occurring elements.

4.4 Hazard controls

The following controls can be implemented to minimise the risk of contaminating the water supply:

- Ensure that there are no leaks / breaches in any plumbing (sewage) lines which may come into contact with the water supply
- Ensure that no animals / vermin can gain access to the potable water supply.
- Maintain / service all potable water system components in accordance with any manufacturer requirements
- Ensure an appropriate water treatment system is in place to treat potable water to a quality suitable for drinking (as required)
- Conduct a pre-commissioning round of water quality monitoring to determine which water treatment measures will be necessary to ensure the water supply is suitable for drinking.

The New South Wales Private Water Supply Guidelines (NSW Health 2016) recognises that water should be clear, have little taste or smell and no suspended solid content which comes from a well maintained catchment (i.e. roof gutters) is unlikely to cause illness in the majority of people using rainwater as a potable source, but is not a guarantee that contamination does not exist. These guidelines provide a number of operational requirements to minimise any contamination risk associated with rainwater tanks and should be cited for requirements in a domestic setting.

4.5 Monitoring program for the drinking water distribution system

Ongoing verification/testing of drinking water can be undertaken to ensure that the supply is safe for human consumption. In addition to the water available for distribution, ongoing verification of the raw (source water) can be conducted to provide early detection of potentially hazardous substances that may occur in the raw water over time.

A summary of potential drinking water contaminants and general parameters used as an indicator of water quality are provided in Table 7 (as sourced from the ADWG). The list is not exhaustive and does not include all possible parameters.

The recommended verification monitoring frequencies for each parameter are provided as a minimum requirement, along with the ADWG values to assess monitoring results. It is noted that a site specific risk assessment can be conducted on a regular basis by a suitably qualified person and the frequency of testing modified as considered necessary based on risk. Additional contaminants may be analysed if other risks are identified and advice should be sought by a suitably qualified water quality expert.

Table 7. Monitoring parameters, guideline values and recommended minimum monitoring frequencies for the drinking water distribution system where the water is sourced from **roof water** and **tanker imports** from an approved source.

Parameter	ADWG value	Notes	Commissioning	Daily	Weekly	Monthly	Quarterly	Annually
Physico-chemical								
pH	6.5 - 8.5		✓				✓	
Turbidity	-	Aesthetic value = 5, however <1 for effective	✓				✓	

Parameter	ADWG value	Notes	Commissioning	Daily	Weekly	Monthly	Quarterly	Annually
		disinfection						
Dissolved Oxygen	-	Aesthetic value = >85 % saturation	✓				✓	
Electrical conductivity	-	Aesthetic value = 0.94 mS/cm	✓				✓	
Micro-biological								
Escherichia coli	<1 CFU/100 mL	Microbial indicator organisms	✓				✓	
Faecal coliforms	<1 CFU/100 mL		✓				✓	
Others as specified in ADWG – Protozoa and viruses	Refer to ADWG	Refer to ADWG						✓
Disinfectant (where applicable)								
Chlorine	5 mg/L	Aesthetic value = 0.6 mg/L	✓			✓		
Free residual chlorine – measured in the field using a diethyl-phenylenediamine (DPD) colour comparator.		Target of 0.2 to 0.5 mg/L in the water supply to reduce micro-biological pathogens	✓			✓		
Disinfection by-products (where applicable)								
Bromate	0.02 mg/L	If ozone is utilised						✓
Trihalomethanes	0.25 mg/L	Where applicable						✓
Trichloroacetaldehyde	0.1 mg/L	Where applicable						✓
Chloroacetic acid	0.15 mg/L	Where applicable						✓
Dichloroacetic acid	0.1 mg/L	Where applicable						✓
Trichloroacetic acid	0.1 mg/L	Where applicable						✓
Other drinking water treatment chemicals that may be used	Various	As specified in ADWG & where applicable						✓
Antimony	0.003 mg/L							✓
Aluminium	-	Aesthetic value = 0.2 mg/L						✓

Parameter	ADWG value	Notes	Commissioning	Daily	Weekly	Monthly	Quarterly	Annually
Arsenic	0.01 mg/L							✓
Barium	2 mg/L							✓
Boron	4 mg/L							✓
Cadmium	0.002 mg/L							✓
Chromium	0.05 mg/L							✓
Copper	2 mg/L	Aesthetic value = 1 mg/L	✓					✓
Iron	-	Aesthetic value = 0.3 mg/L	✓					✓
Lead	0.01 mg/L		✓					✓
Manganese	0.5 mg/L	Aesthetic value = 0.1 mg/L						✓
Mercury	0.001 mg/L							✓
Molybdenum	0.05 mg/L							✓
Nickel	0.02 mg/L		✓					✓
Selenium	0.01 mg/L							✓
Silver	0.1 mg/L							✓
Uranium	0.02 mg/L							✓
Zinc	-	Aesthetic value = 3 mg/L	✓					✓
Toxic algae								
As specified in ADWG			✓					✓
Microcystins	0.013 mg/L	Microcystins are hepatotoxic peptides that are produced by a range of cyanobacteria						✓

The New South Wales Private Water Supply Guidelines suggests that a comprehensive analysis of physical and chemical quality of the water supply should be conducted initially, and the range of parameters to be analysed should be decided according to the risk they pose to the water supply. Furthermore, the aforementioned guideline recommends the chemical and physical water quality be tested at least annually. A flow process diagram is provided in Appendix A, Figure 1.

4.6 Potable water quality

The principal sources of contamination associated with roof water are faecal matter from birds and other flying and climbing animals, dead insects, and debris collected on roofs. Contamination is not expected in potable water imported from an approved source by a licensed service provider.

The impact of roof water contamination can be minimised by the following:

- Clearing / cleaning guttering regularly
- Overhanging and immediately adjacent branches should be removed as they can be a source of debris and can increase access to roof catchment areas by birds and animals
- Inlet pipes to tanks should include leaf litter strainers with appropriate screens to prevent mosquito infestation.

First flush diverters, which prevent the initial roof-cleaning wash of water (20 - 25 L) from entering tanks, should be utilised.

Water treatment devices are a core component of many water treatment systems and include a variety of different ways of treating water but the most common treatment devices for a domestic setting relate to filtration and disinfection of water.

The New South Wales Private Water Supply Guidelines recommends when selecting a treatment device to seek one with certification in accordance with AS/NZS 3497:1998 Drinking Water Treatment Units and AS/NZS 4348:1995 Water Supply – Domestic Type Water Treatment Appliances. A reputable supplier should be able to provide certification / performance data for their devices.

Where disinfection of potable water is required, the most common disinfection agents used are ultraviolet (UV) light disinfection or chlorine disinfection.

4.6.1 CHLORINE DISINFECTION FOR PATHOGEN CONTROL

If a microbial risk is identified in the potable water tank, and an automatic chlorine dosing system is not utilised or insufficient, manual dosing of the tank can be undertaken as an alternative. To achieve initial chlorine concentration of 5 mg/L in the storage tank (assuming no chlorine is present) add:

- 125 mL of liquid bleach (4% available chlorine) for every 1,000 L of water in the storage tank or;
- 40 mL of liquid sodium hypochlorite (12.5% available chlorine) for every 1,000 L of water in the storage tank or;
- 8 grams of granular calcium hypochlorite (65% available chlorine) for every 1,000 L of water in the storage tank.

Residual chlorine should be measured using a field strip or equivalent with a free chlorine concentration of at least 0.5 mg/L recorded. There may be aesthetic impacts to the water but it will be safe for drinking. Furthermore, it is recommended that regular monitoring of free chlorine residual be undertaken at outlets throughout the dwelling to ascertain whether the chlorine dosing is effective. As a guide a chlorine residual of 0.5 mg/L should be present in the water at the tested outlets.

4.6.2 UV DISINFECTION

If UV disinfection is used for treatment of water, it is imperative that the water is not cloudy or turbid water as the light will not adequately penetrate the water, so filtration prior to UV disinfection is crucial.

4.7 Routine maintenance and monitoring

Routine maintenance and monitoring can be undertaken on the water treatment system with reference to the NSW Private Water Supply Guidelines (NSW Health 2016). Details of typical maintenance requirements are provided below. The details below are not exhaustive, and the manufacturer of the supplied water treatment unit/s or system must be consulted in the event additional maintenance is required.

Filtration

Water treatment systems with a filtration unit will need to be routinely checked, and filter cartridges will need to be replaced if flows through the filter cartridge decrease, the water becomes turbid, or at a frequency required to keep the filtration unit in sound working order.

Chlorine dosing

Where chlorine dosing of the treatment system is undertaken, a concentration of 0.5 mg/L of free chlorine should be present at all outlets used for potable supply. In the event that there is insufficient chlorine within the system or microbial risks are identified, manual dosing should be undertaken as per Section 4.6.1 or the manufacturer of the chlorine dosing unit (if an automatic unit is installed) should be contacted to conduct maintenance works.

UV dosing

UV disinfection units must be maintained regularly in accordance with manufacturer specifications. As a minimum the system should:

- Have a stable power supply connected to the unit
- Be operating with lamps intact and free from scum or other build up.

Any required servicing / maintenance requirements must be undertaken as soon as possible by a suitably qualified or licensed person.

4.8 Provision of the Tweed Local Environment Plan

TSC must be satisfied that Section 7.10 of the Local Environment Plan (LEP) 2014 can be complied with for the proposed development. This report provides water balance information and proposed water supply options, which will yield a sustainable water supply for dwellings at the site.

Subject to development consent being provided, a detailed water supply strategy can be prepared for individual dwellings and communal areas (as applicable). This would include details of external water suppliers in the event of dry periods where import water is required.

5 REFERENCES

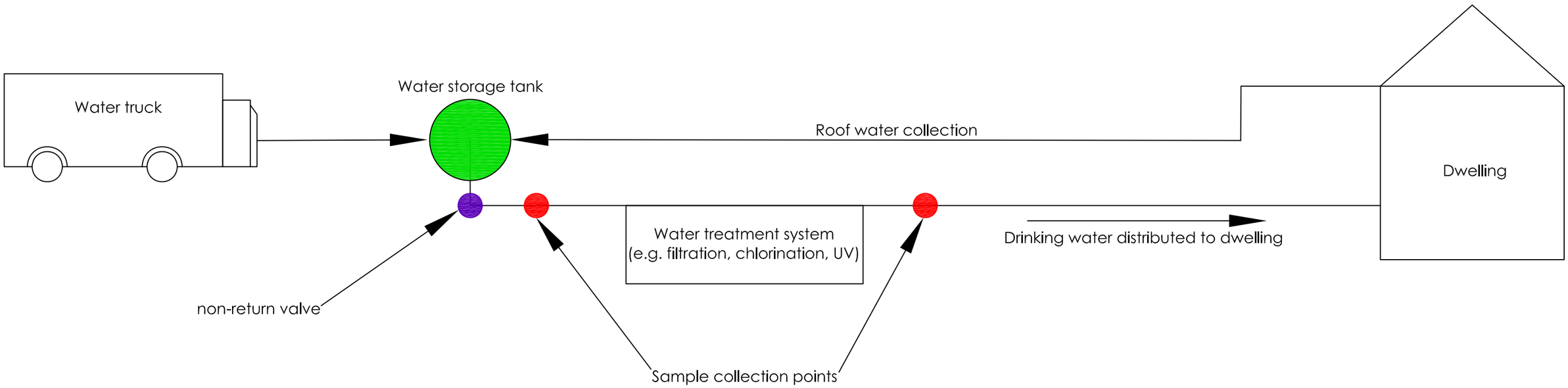
ANZECC/ARMCANZ. 2000. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment and Conservation Council, and Agriculture and Resource Management Council of Australia and New Zealand.

AS/NZS 1547:2012. On-site domestic-wastewater management. Standards Australia International Ltd and Standards New Zealand.

Enhealth 2011. Guidance on use of rainwater tanks, Environmental Health Committee (enHealth) of the Australian Health Protection Committee, March 2011.

PE. 2020. Concept Onsite Sewage Management Design Report, Nightcap Village, Mount Burrell (Kunghur), New South Wales.

APPENDIX A – FIGURES



Client: NCV ENTERPRISES PTY LTD	Site location: MOUNT BURRELL (KUNGHUR), NEW SOUTH WALES		Real property description: VARIOUS - SEE REPORT		Drawing number: FIGURE 1	PRECISE ENVIRONMENTAL Consulting Environmental Scientists Unit 7 / 14 Fremantle Street, Burleigh Heads, Qld, 4220 PO Box 4424, Robina Town Centre, Qld 4230 Ph: (07) 5593 7848 Fax: (07) 5593 7020 mail@preciseenvironmental.com.au
					Drawing version: A	
Project: CONCEPT POTABLE WATER MANAGEMENT STRATEGY	Project number: PE2706.18	Scale: NOT TO SCALE	Drawn by: SG	Reviewed by: CB	Drawing title: SCHEMATIC DIAGRAM OF POTABLE WATER SUPPLY SYSTEM	
			Date drawn: 26.03.2019	Approved: CB		

Figure 2

ECOLOGICAL CONSTRAINTS / OPPORTUNITIES ANALYIS

LEGEND

- MAPPED HIGH QUALITY ECOLOGICAL FOOTPRINT
- IDENTIFIED ECOLOGICAL LINKAGES
- SITE LINKAGES TO WIDER ECOLOGICAL VALUE

PLANIT CONSULTING

NIGHTCAP ECO VILLAGE
CONSTRAINTS ANALYSIS

Date: NOVEMBER, 2019 Drawn: JW
Scale: 1:10000 @ A1 Checked: DM
Rev: 02

0 200 400 600
SCALE - 1:10000 @ A1 , 1:20000 @ A3